Exhibit 3. Technical Reporting Format

Africa RISING Progress Report Template

Instruction: *This template should be used for interim and final technical reports. Final reports should include supporting data (tables and graphs) under Section D. No tables and graphs are needed for interim reports.*

Reporting Period: October 2012 – September 2013

Section A. Partner Information

A.1. Institute: International Center for Tropical Agriculture (CIAT)

A.2. Contact person: Lulseged Tamene Desta

A.3. Intervention site, country: Dedza and Ntcheu (Malawi)

A.4. Partners: MSU, ICRAF, University of Malawi

Section B. Summary of progress/achievements during the reporting period (What are the two key achievements?)

Despite the fact that actual field and research activities started relatively late, we managed to successful undertake extensive field survey 'surrounding' all the eight intervention sites in the districts of Dedza and Ntcheu, Malawi. The aim of the survey was to characterize the sites mainly in terms of landscape condition and soil health. In addition to the 'biophysical' characterization, agronomy survey was conducted in one of the intervention sites to assess yield gap and evaluate key drivers. Socio-economic survey was also undertaken to collect information on the major constraints and potentials of households, specifically related to technology choice and adoption processes. The results of the analysis can inform planning future Africa RISING activities and specifically aid providing landscape and soil health related information that facilitate intensification in a sustainable manner. The 'landscape' based data and results can also guide the up-scaling processes at a later stage.

Section C. Implemented work and achievements per output (less than 200 words per activity)

C.1 Research Output 1 (RO1): Situation analysis and program-wide synthesis. Please refer to the Program Document for Activity Headings.

C.1.1. Activity: Synthesize local community

C.1.1.1 Implemented work: Conduct site visit to create awareness with local communities and plan field activities

C.1.1.2 Achievements (progress and/or results):

For projects to succeed (either implementation or technology dissemination), it is essential to involve relevant stakeholders from the onset. We thus visited local chiefs, government officials

and extension workers within each of the intervention areas to discuss project objectives and intended field activities. This was an essential step as it facilitated our field survey activities including assigning local extension workers and farmers to participate in the fieldwork. During this field visit, we also recorded the GPS locations of the eight intervention sites within the two districts, which helped guide designing sampling site randomization.

C.1.2. Activity: Baseline biophysical data collection

C.1.2.1 Implemented work: Conduct biophysical baseline survey to characterize landscape condition and soil health status of the intervention sites

C.1.2.2 Achievements (progress and/or results):
The sampling framework intended to assess landscape condition and soil health constraints was designed such that the center of each of the intervention sites was aligned to become the center of the sampling clusters (Fig. 1). A hierarchical spatially stratified, random sampling approach, which replicates soil and other biophysical measurements at different spatial scales, was employed to locate sampling points. The sampling design involves sites that are 10,000 ha in size. Each site is stratified into 16 clusters of 100 ha, and each cluster is randomly stratified into 10 sampling plots of 0.1 ha size. This sampling design is adopted as it helps to capture spatial variability and facilitate up- and out-scaling of results. Field data has been collected from 640 sampling points of the eight intervention sites (160 sampling points from 16-clusters). Detailed information related to landscape attributes and processes such as land use, trees/shrubs (number, height, diameter at breadth height, density), surface cover, root depth restriction, infiltration, slope, terrain form and characteristics, conservation practise, and erosion prevalence were recorded for each sampling point. Over 1260 soil samples (topsoil (0-20 cm) and subsoil (20-50cm) have been collected from all sampling sites. About 10% of the soil samples have been subjected to wet chemistry analysis at CropNuts in Nairobi while the rest were scanned using mid-infrared spectroscopy. Soil properties for the remaining sampling plots were then predicted using spectral prediction model developed at ICRAF using spectral library composed of thousands of soil samples.

C.1.3. Activity: Agronomic and socio-economic survey

C.1.3.1 Implemented work: Conduct agronomic and socio-economic survey to assess yield gap and analyze potential drivers for yield variability between farming households

C.1.3.2 Achievements (progress and/or results):
Land health information based on landscape condition assessment alone cannot give complete information about the socio-economic processes and management practices that determine landscape health and its productivity. To rectify this shortcoming, co-located agronomic and socio-economic surveys were conducted for some of the intervention areas. Agronomic survey tool was used to assess grain yield of households from plots corresponding to the respective biophysical sampling points. Replicated yield measurement was conducted on two plots of 3m by 3m size in a 9m by 9m-sampling area. Information related to farmers'' management constraints was also collected using semi-structured interview and field observation. In addition, socio-economic survey was conducted to collect data related to household characteristics, assets, technology adoption constraints, risk coping mechanisms and land management practices. The sampled household correspond to some of the locations from where biophysical and agronomic data has been collected.

C.1.4. Activity: Landscape and soil health assessment

C.1.4.1 Implemented work: Analyze landscape condition and soil health status of the study sites

C.1.4.2 Achievements (progress and/or results):

Basic landscape metrics analysis shows that out of the 640 sampling points, over 80% are cultivated areas. The four sites show variability in their proportion of cultivated areas where Golomoti site has lower proportion of 60% while Linthipe has higher proportion of cultivated area of 88% (Fig. 2a and b). More trees and/or shrub are observed in cultivated areas of Linthipe and Kandeau sites compared to those of Golomoti and Nsipe. There is also variability in tree density within and between sites. Analysis of topsoil root depth restriction (RDR) shows that there is only about 4% probability of observing root depth restriction in all the four sites. In all cases, cultivated/managed areas show lower probability of occurrence of RDR compared to non-cultivated areas. Saturated infiltration capacity estimated using a non-linear mixed-effects model shows different infiltration capacity of the four sites with Linthipe showing consistently low infiltration rate (Fig. 3a). Higher infiltration rate is associated with areas of better tree and/or shrub cover than those with no trees and/or shrubs. In addition, cultivated areas show low infiltration rate compared to non-cultivated areas (Fig. 3b). Erosion prevalence estimate shows about 55% probability of observing erosion, the highest being at Nsipe (70%) and the lowest at Linthipe (30%) (Fig. 4a). Erosion prevalence also shows variability within sites (at cluster level, Fig. 4b), which can be attributed to distinct land use and management between clusters. A closer look of the erosion prevalence result shows that the 'mother trials' of interventions in each of the sites generally show low erosion risk.

As to soil health properties, average pH for Kandeau and Linthipe is about 6.2 and that of Golomoti and Nsipe is 6.5. Average topsoil phosphorus (Mehlich 3 extraction) for Galomoti, Kandeau, Linthipe and Nsipe is about 38, 20, 12, and 23 mg/kg, generally suggesting that Linthipe is P deficient and the other two sites require fertilization. Average potassium (K, Mehlich 3 extraction) for the four sites is also within the low level despite the fact that some plots are within the optimum amount. Soils in the study sites appear to be deficient in nitrogen concentration (Fig. 5) with observed average amount of 0.73, 0.66, 1.02 and 0.74 g/kg for the Golomoti, Kandeau, Linthipe and Nsipe sites, respectively. On the other hand, soil organic carbon content for the study sites shows average values of 18 g/kg, 15 g/kg, 26 k/kg, and 17 g/kg for the Golomoti, Kandeau, Linthipe and Nsipe sites, respectively. Like the other cases, SOC concentration also shows high variability within sites (between clusters and plots in the same site. Figure 6 shows tentative distribution map of acidified carbon for Golomoti and Kandeau sites predicted based on Landsat ETM derived reflectance values and ASTER 30-m resolution derived terrain attributes.

C.1.5. Activity: Yield gap analysis and assessment of determinant factors (on-going)

C.1.5.1 Implemented work: Analyze yield gap and major drivers based on agronomic survey data of one site

C.1.5.2 Achievements (progress and/or results):

Average yield value for two replicates (Figure 7) ranges between 3.9 and 4.0 t ha-1, with standard deviation of 0.2. The variety SC709 produced the highest yield (12.02 ton/ha). The yield is within

the yield potential of the variety (6 - 12 ton/ha) as indicated by literature (GoM, 2006). Management of the crop in this field included application of NPK (23:21:0+4S) and Urea (46%N), as well as manure (4000kg) (chicken droppings + goat dung), but also intercropping (with beans). Mixed effect modelling results show that variety, manure application, fertilizer use, intercropping with legumes, weeding time and frequency, and plant spacing are the major determinants of yield gap in the Linithipe site (Figure 8). Fig. 9 shows clusters 11 and 12 have high yield compared to the others. These sites are where the mother trials are located and the increased yield can be attributed to improved management practices, exposures to technologies and extension services. These two clusters also are among the lowest affected by erosion and other degradation processes.

C.1.6. Activity: Analyze drivers and constraints of technology adoption (on-going)

C.1.6.1 Implemented work: Analyze the major drivers of technology choice and adoption in one example site

C.1.6.2 Achievements (progress and/or results):

Figure 10 shows the different technologies farmers are exposed for adoption and the general tendency of adoption. Generally, farmers seem to prefer employing inorganic fertilizer. In general more farmers are dis-adopting technologies in Linthipe than in Nsipe. Larger dropouts of more than 20% are observed in 7 of the 10 technologies. Among the ten technologies observed, mulch, lime, fallow, compost, and agroforestry are adopted by few farmers and/or are being dis-adopted by large number of farmers. Based on the semi-structured interview of about 320 households, the major reasons for the less adoption and/or dis-adoption of technologies in the two sites include lack of technical know-how and high labour demand as constraints. The major reasons however vary between the two sites. The results show the challenges of disseminating and adopting some interventions such as mulching and fallowing considering the local circumstances of farmers.

C.1.X. Additional activities, if any

C.2 Research Output 2 (RO2): Integrated Systems Improvement. Please refer to the Program Document for Activity Headings.

C.2.1. Activity:

C.2.1.1 Implemented work:

C.2.1.2 Achievements (progress and/or results):

C.2.2. Activity:

C.2.2.1 Implemented work:

C.2.2.2 Achievements (progress and/or results):

C.2.X. Additional activities, if any:

C.3 Research Output 3 (RO3): Scaling and Delivery. Please refer to the Program Document for Activity Headings.

C.3.1. Activity:

C.3.1.1 Implemented work:

C.3.1.2 Achievements (progress and/or results):

C.3.2. Activity:

C.3.2.1 Implemented work:

C.3.2.2 Achievements (progress and/or results):

C.3.X. Additional activities, if any:

C.4 Research Output 4 (RO4): Monitoring and Evaluation. Please refer to the Program Document for Activity Headings.

C.4.1. Activity:

C.4.1.1 Implemented work:

C.4.1.2 Achievements (progress and/or results):

C.4.2. Activity:

C.4.2.1 Implemented work:

C.4.2.2 Achievements (progress and/or results):

C.4.X. Additional activities, if any:

C.5. Research Deliverables

C.5.1. Products

C.5.2 Technology/technologies transferred

C.5.3 Meetings/presentations

Lulseged Tamene, Powell Mponela, Gift Ndengu, Job Kihara. (2013). Landscape characterization to assess biophysical determinants of sustainable intensification. Presentation made at Africa RIsING planning meeting at Salima, Malawi (29 July – 1 August 2013).

C.5.4 Reports/publications

Draft manuscripts for publication are being prepared.

C.5.5. Capacity building (Type of training, number and category of people trained)

Eight extension agents trained in land degradation surveillance framework (LDSF) survey protocol. In addition, four extension workers trained in agronomic survey to estimate yield gap.

C.6. Problems/challenges and measures taken *(100 words)*

Some challenges faced include late start of field activities, delay in MoU signing and thus significant delay in dispersing funds. In order to minimize impact on deliverables, we "pre-financed" the project and managed to undertake fieldwork and other activities. Soil lab sample analysis also delayed which affected timely and detailed data analysis and reporting.

C.7. Partnership/linkages with other projects (*100 words****)***

This project can be linked to the "sustainable intensification' theme of the Drylands Program (CRP1.1). Since the CRP 1.1 sites are generally located with the same region to that of the Africa RISING sites, experiences gained within CRP1.1 (Chinyanja Triangle) can be contribute to the up-scaling of technologies from Africa RISING sites to wider geographical regions.

C.8. Lessons learned (*100 words****)***

Integrated analysis of landscape condition/soil health constraints, yield gaps, farmers management practices and household typologies including constraints and coping mechanisms can help implement 'systems approach' and identify suitable entry points and implement sustainable intensification. The landscape related data and further analysis of those data will provide great opportunity to sustainably intensify farming systems, conduct tradeoff analysis and facilitate designing up- and out-scaling approaches. With all these potential benefits however there is a need to enhance partnerships and design mechanisms of enhancing and effecting integration between the different partners.

Section D. Tables and graphs in support of achievements, results (for final report only)

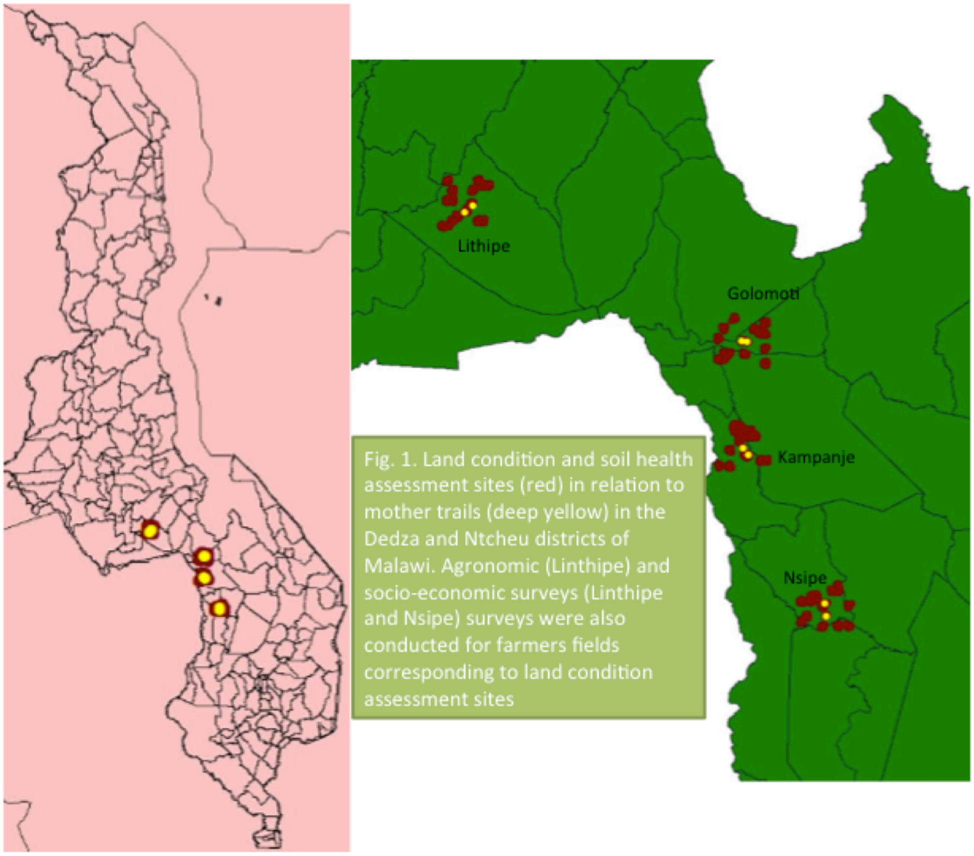

Figure 1. Location of the four sites (red) in Dedza and Ntcheu districts of Malawi including the distribution of the eight intervention sites/mother trains

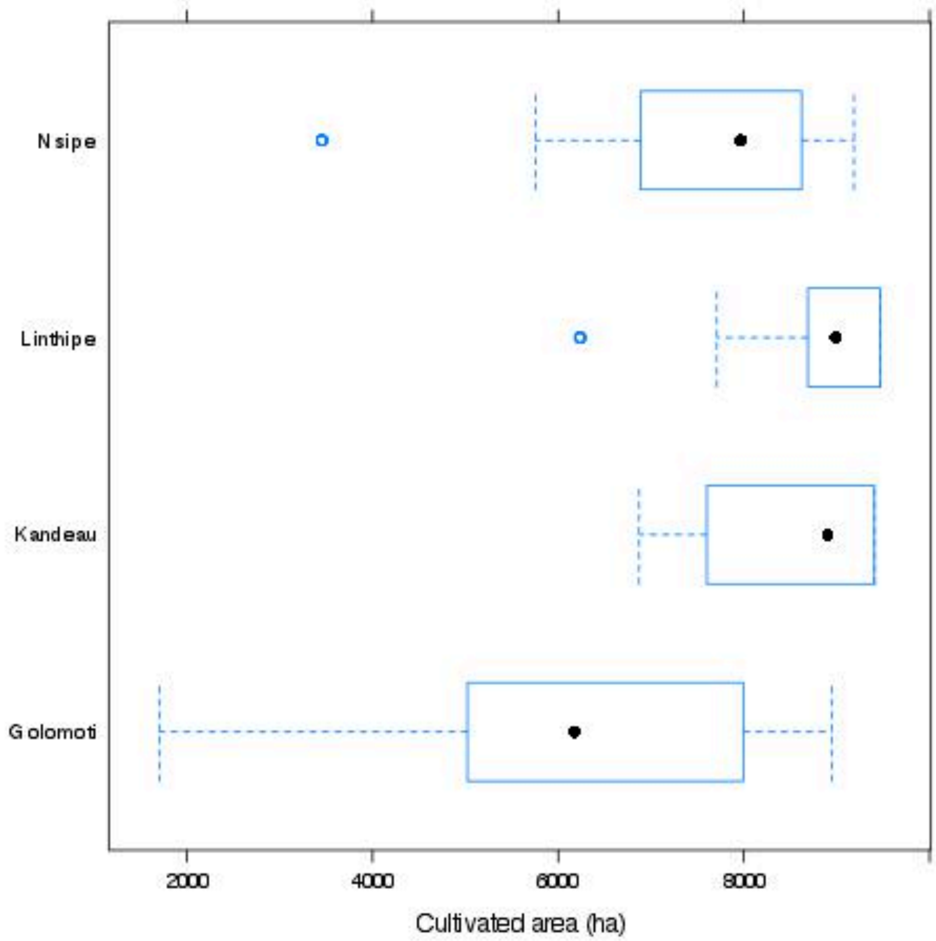

Figure 2a. Proportion of cultivated areas of the four sites

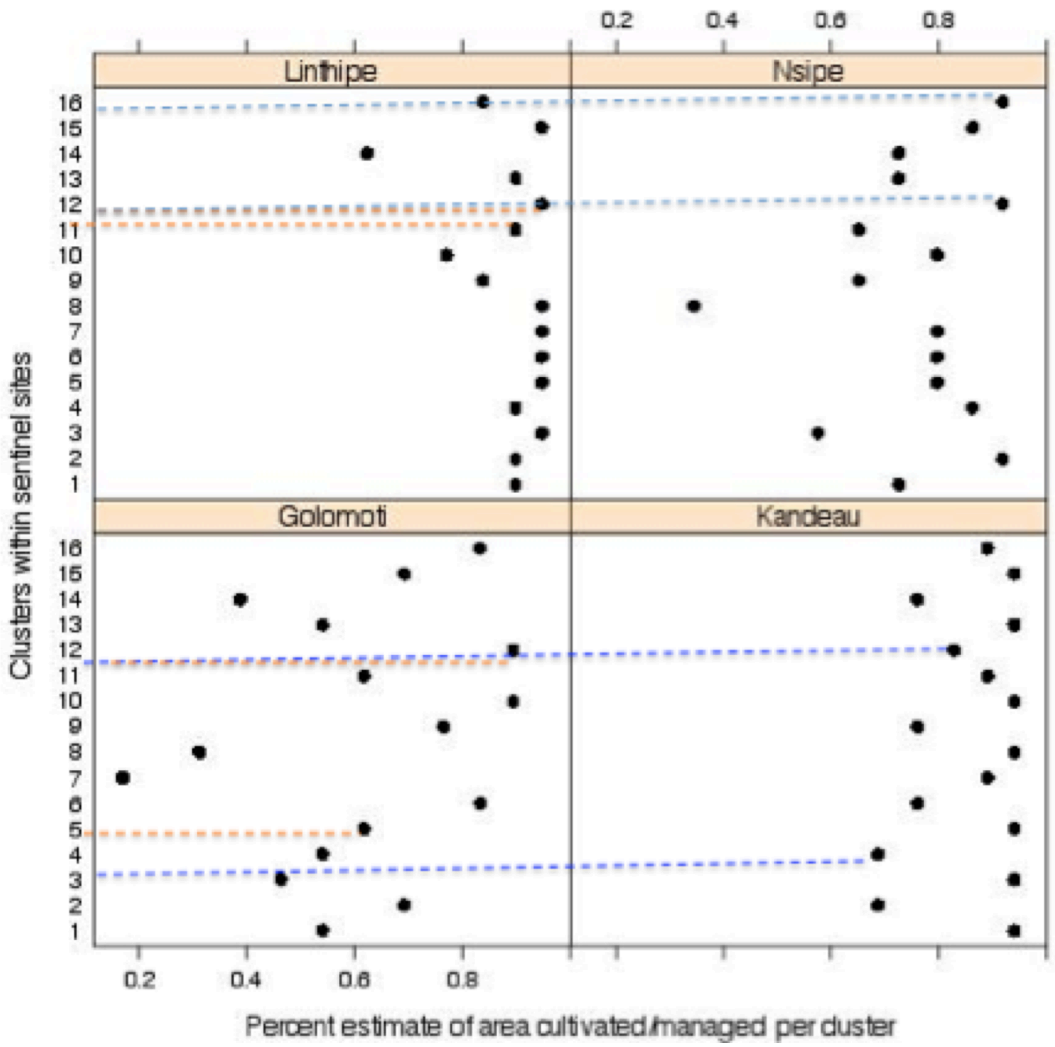

Figure 2b. Percent estimate of cultivated area and its variability between clusters of the different sites

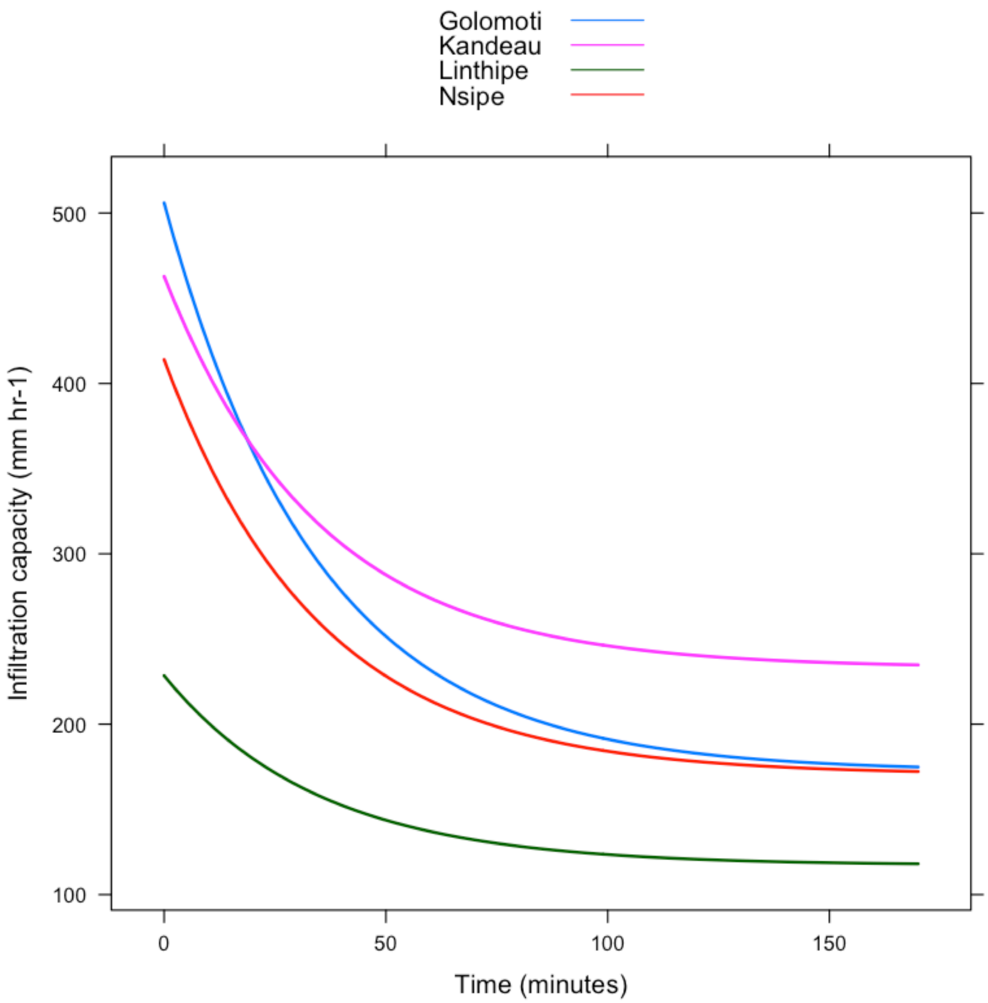

Figure 3a. Infiltration rate of the four sites in Malawi

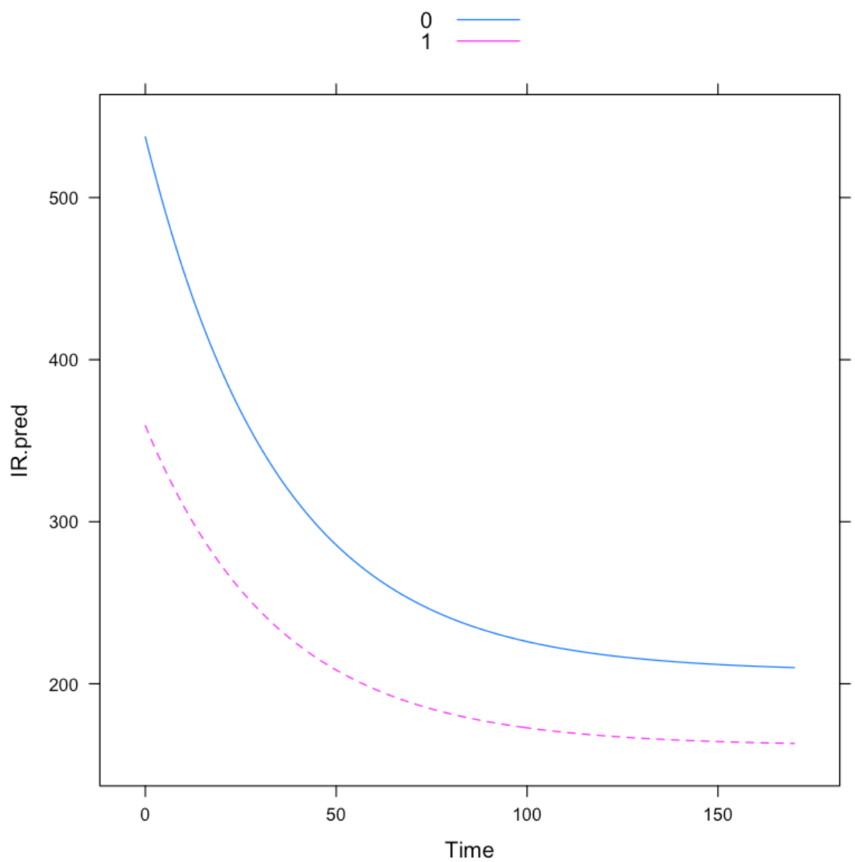

Figure 3b. Average infiltration rate in the four sites considering cultivated (1) and non-cultivated (0) sites.

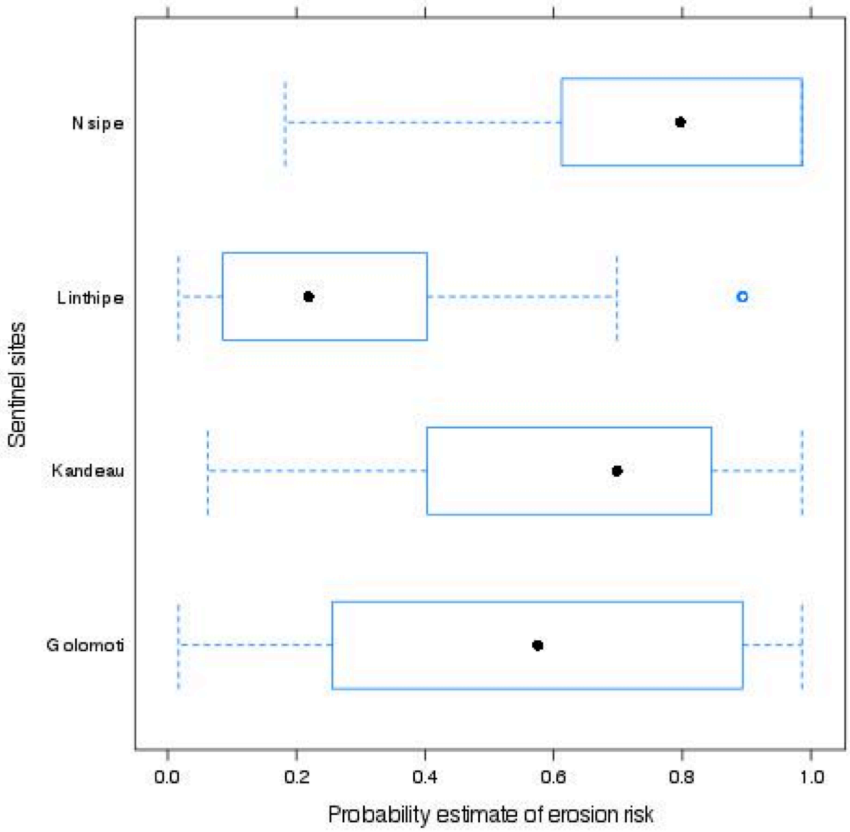

Figure 4a. Erosion prevalence estimate showing within site variability

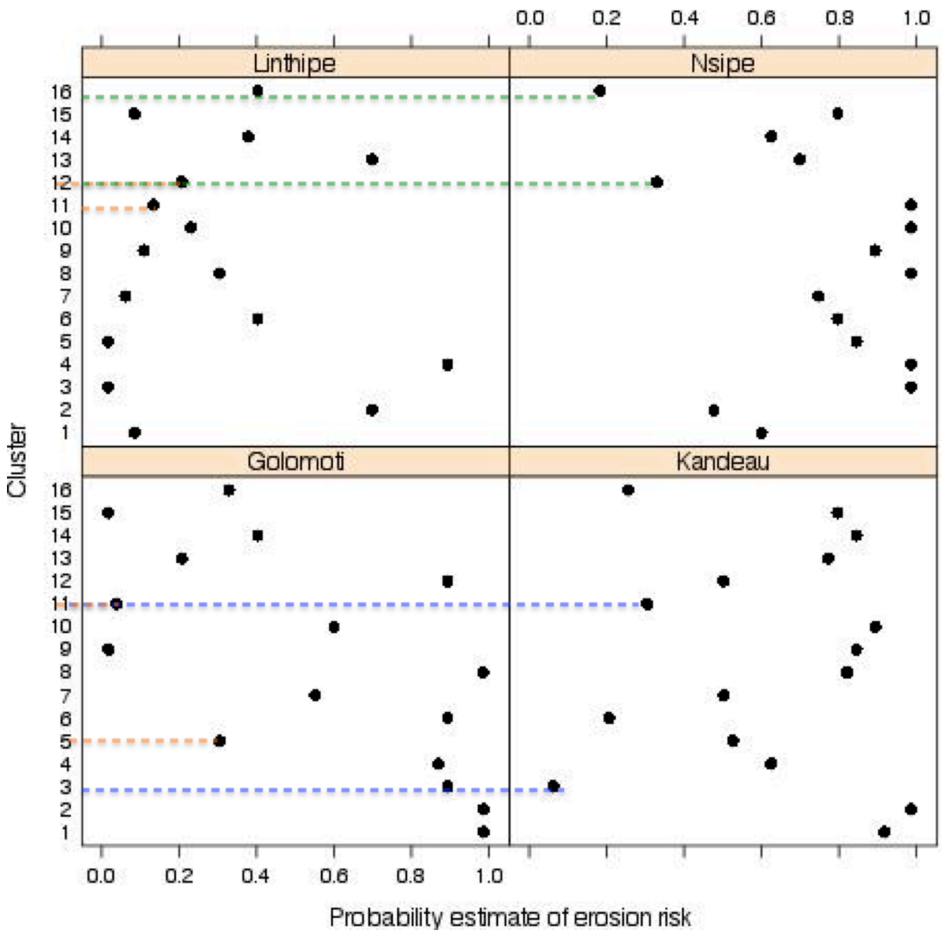

Figure 4b. Erosion prevalence and its variability within each site. The doted lines show clusters corresponding to the intervention areas in each of the sites

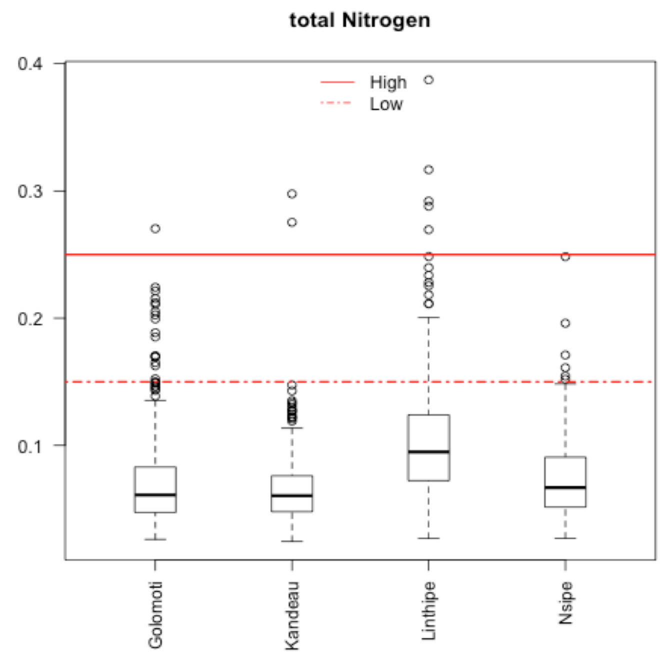

Figure 5. Total nitrogen concentration and its variability within four sites of Dedza and Ntcheu districts, Malawi

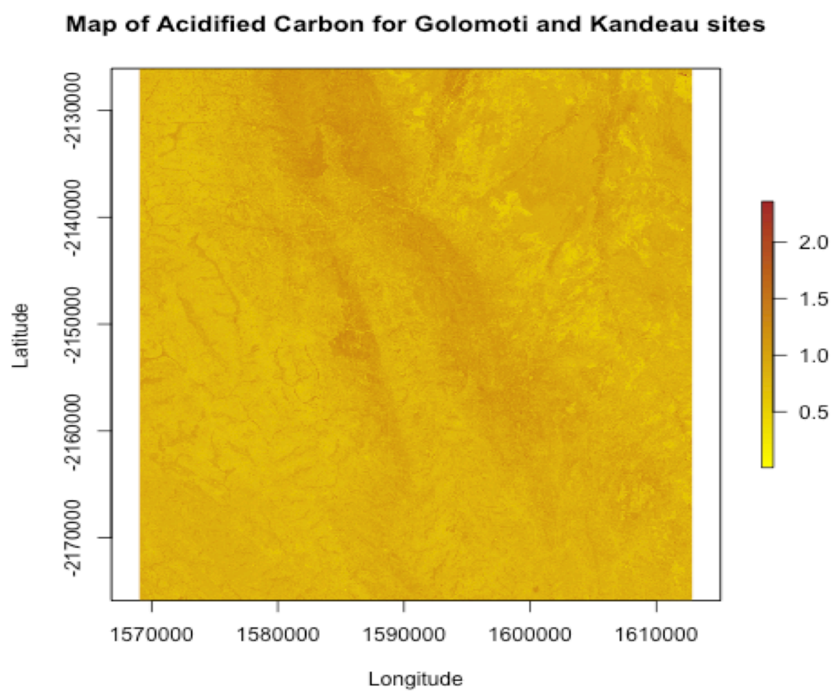

Figure 6. Spatial distribution of acidified carbon for Golomoti and Kandeau sites. Note that the map is tentative, as improvement will be made on co-variates used and the modeling approach. This and for other sites and elements will be improved

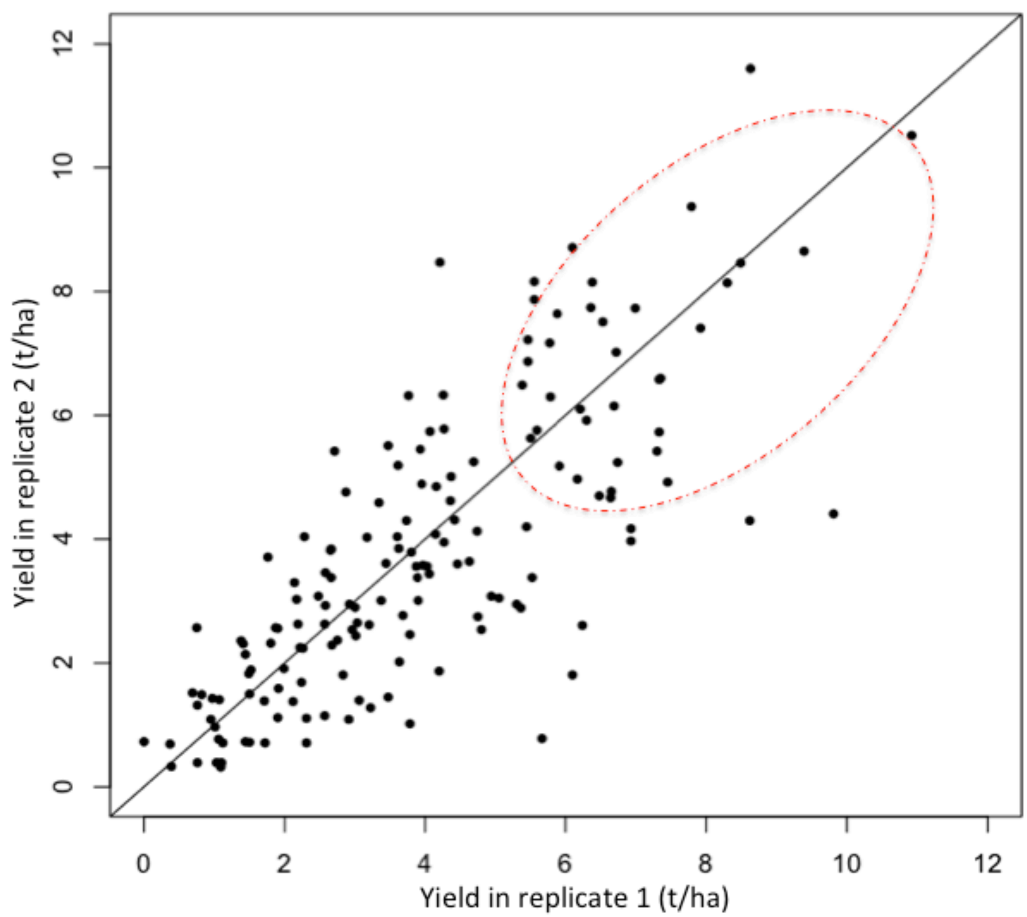

Figure 7. Maize grain yield estimates for two replicated 3m by 3m plots at Linthipe site, Malawi

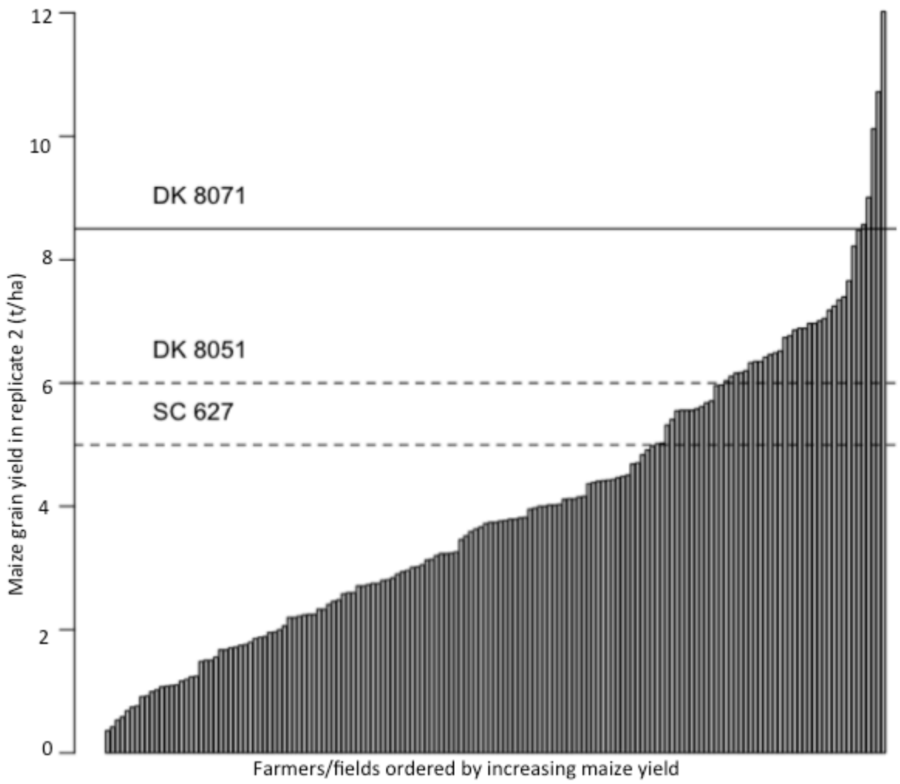

Figure 8. Observed yield and potential exploitable yield gap based on 160 households in Linthipe site, Malawi

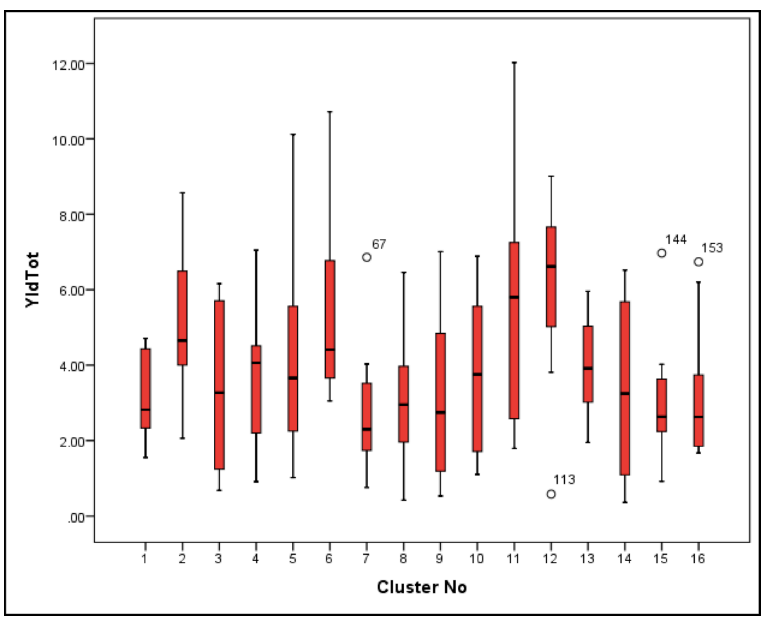

Figure 9. Maize grain yield variability within sites (between clusters)

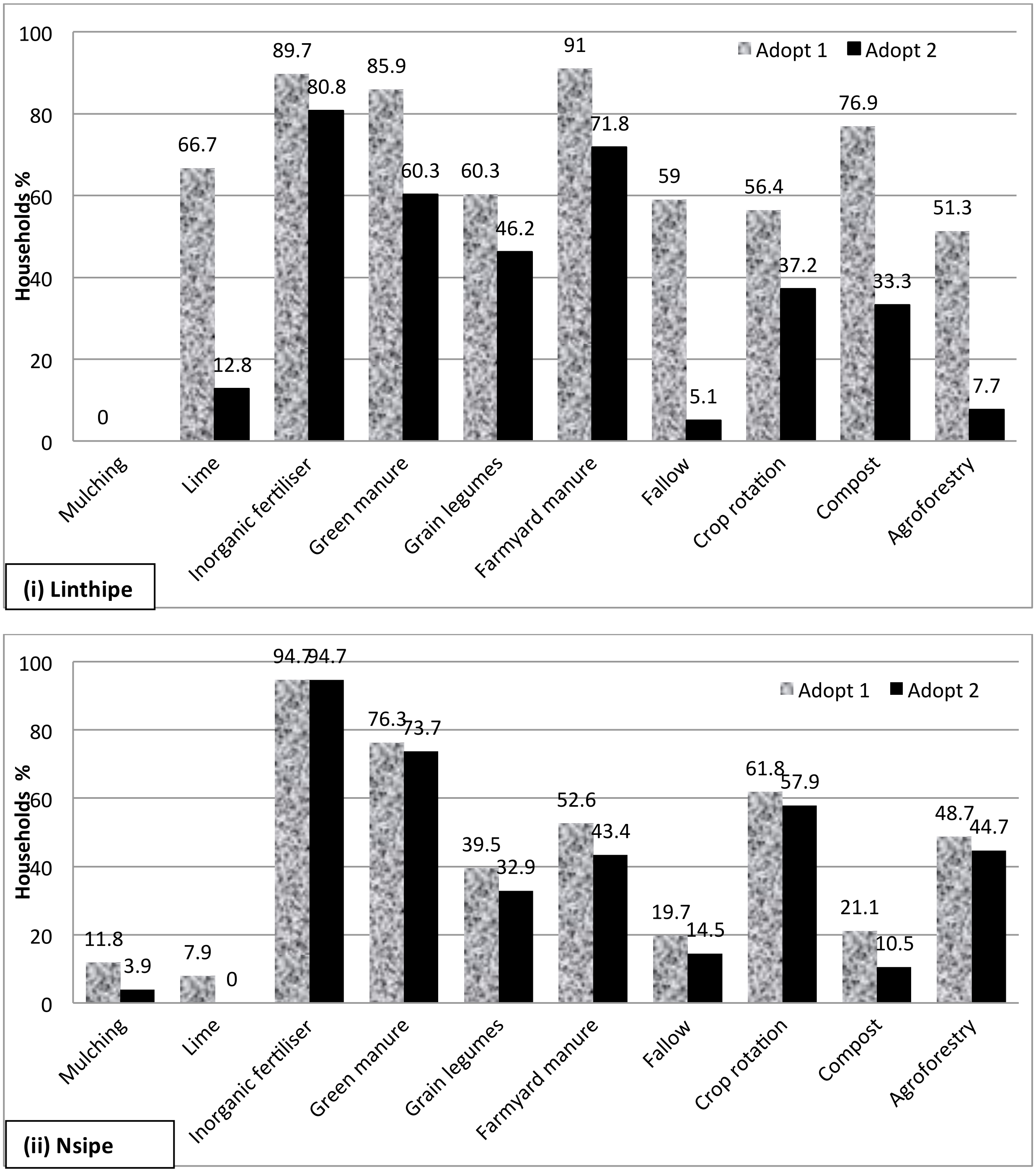

Figure 10. Proportion of farming households that ever used (adopt 1) and those that still use (adopt 2) ISFM technologies in (1) Linthipe and (ii) NSipe EPAs

Section E. Success story (for final report only, 200-300 words)

We have managed to conduct landscape and soil health characterization covering all the Africa RISING intervention sites (surrounding the mother trails). We tried our best to be able to achieve this despite the fact that the original plan and budget was to cover few sites. In addition, we managed to undertake agronomic and socio-economic surveys for households co-located to the land condition assessment sites. Besides such rich dataset, the yield gap and technology adoption constraints analysis can provide an insight related to areas of focus that can help sustainably intensify and improve food security of poor farmers in the Southern Africa region.

Section F. **Feed the Future indicators** (for final report only)

As we are at the 'characterization and situation analysis' stage of the project, it will not be possible to state explicit Feed the Future indicators tackled. As it stands now, we can report that about 12 extension staff and more than 5 high school complete have been trained in land condition assessment and agronomic survey practices.